

Please add the following new Claims 8-10:

8. (New) The transmission cable of Claim 1 wherein the electroconductive material layer is disposed along an entirety of the surface of the support element.

9. (New) The transmission cable of claim 1 wherein a plane of contact between the first surface and the second surface is along a plane of a surface of the support element.

10. (New) The transmission cable of Claim 1 wherein a groove is disposed along each side of the support element, each groove being formed between a wall of the cavity and a side of the support element.

REMARKS

1. Claim 1 is amended. Claim 7 is cancelled. The specification is amended. Claims 8-10 are new. A proposed drawing correction is being submitted herewith. A marked-up version of the rewritten paragraphs and claims is attached hereto.

2. Claim 1 has been amended to address the objections related to terminology noted by the Examiner. The changes do not further narrow the scope of the claim and are not made for reasons related to patentability.

3. The specification has been amended to include section headings as requested. With regard to the objections to

terminology or phraseology, those that are improper have been clarified.

4. Claims 1, 2 and 6 are not anticipated by published EP ('831) the equivalent of which is U.S. Patent No. 5,990,768 to Takahashi et al. ("Takahashi"), under 35 U.S.C. §102(b). Takahashi does not disclose or suggest a "support element" as claimed and described by Applicant. Applicant's invention according to Claim 1 recites that the transmission cable is located in a cavity comprising a first surface and a second surface. The support element has a "surface that is essentially parallel with said first and second surfaces and is located between said first and second surfaces." The protrusion 511 of Takahashi cannot be said to be located "between said first and second surfaces" as is claimed by Applicant. Rather, in Takahashi, as is shown in FIGS. 4A and 4B, the protrusion 511 is actually the surface of the second crystal substrate 501. Only the microstrip line 508 is between anything. Thus, this feature of Applicant's invention is not disclosed or suggested by Takahashi.

Also, Claim 1 recites that the electroconductive material layer is disposed on a surface of the support element. In Takahashi, the microstrip line 508 is located on the protrusion 511, which is part of the substrate 501. In Applicant's invention as recited in Claim 1, the surface of the support element is not the first or second surface. Thus, Applicant's Claim 1 is not disclosed or suggested in Takahashi.

Furthermore, in Takahashi, the reference sign 508 does not refer to a support element as described and claimed by Applicant. Rather in Takahashi a microstrip line 508 is shown on a surface of the protrusion 511. (Col. 6, lines 65-66). "The protrusion

511 is formed such that the protrusion fits into the groove 509, where the cavity 513 is formed." (Col. 7, lines 3-5). In Applicant's invention, the "support element" as claimed and described is not a "protrusion" that fits into a groove, such as groove 509 of Takahashi.

Also, unlike Applicant's invention, the ground cable 503 is not essentially parallel to the signal cable 508 in every place because it is bent on its outer edge, which can be clearly seen in both FIGS. 4A and 4B, for example.

Also, it should be noted that Takahashi does not disclose or suggest any of the advantages achieved by Applicant's invention, some of which are described on page 4, lines 10-15.

Therefore, since each element of Applicant's invention as recited in Claim 1 is not disclosed or suggested by Takahashi, it is respectfully submitted that Claim 1 is not anticipated by Takahashi under 35 U.S.C. §102(b). Claims 2-6 depend from Claim 1 and should be allowable in view of the dependencies.

5. Claim 3 is not obvious over EP '831 ("Takahashi") under 35 U.S.C. §103(a).

As noted above, Takahashi does not disclose or suggest a support element as claimed by Applicant. In Takahashi, the protrusion 511 must fit into the groove 509, (Col. 7, lines 3-5), so that the conductor film 510 surrounds the microstrip line 508. Takahashi does not disclose or suggest that the groove 109 or 509 can be anything other than as shown in the drawings.

Furthermore, a purpose of Takahashi is to reduce loss at a millimeter band. (Col. 7, lines 9-10. If the groove 509 were rectangular or square, as in Applicant's invention, there could

be difficulty in forming the layer 503 on the crystal substrate 504 in order to achieve the objectives of Takahashi, particularly since there would be sharp, 90° angles in a square or rectangle. In Takahashi, such angles could pose a problem. In Applicant's invention, the support element does not have to fit in a groove, such as that described by Takahashi. Thus, a square or rectangular shape is not suggested by Takahashi. The Examiner is respectfully reminded that the Examiner is required to indicate where (page and line number) such a teaching or suggestion appears in the prior art. Ex parte Jones, 62 U.S.P.Q. 2d 1206, 1208. See also In re Rijckaert, 28 U.S.P.Q. 2d 1955, 1957 (Fed. Cir. 1993). Therefore, Claim 3 should be allowable.

6. Claim 5 is not disclosed or suggested by Takahashi in view of Japanese Abstract ('814). The '814 document fails to disclose or suggest a support element as claimed and described by Applicant. It is submitted that Takahashi does not disclose or suggest two curved surfaces. Takahashi, as described, might likely be rendered ineffective with curved surfaces.

7. Claim 8 recites that an electroconductive material is disposed on the whole surface of the support element. This is not disclosed or suggested by EP '831. Referring to FIGS. 2-6 of Applicants' disclosure, it clearly illustrates that the whole surface of the support element is covered. The signal cable 105c of Takahashi does not cover the whole surface of the protrusion 511, or 508. This feature of Applicants' invention provides distinct advantages not disclosed or suggested by the prior art. If the whole support element is covered by electroconductive material, then the electromagnetic field is better confined in the air filled cavity region. The electromagnetic field does

not leak out of the cavity into/through the dielectric and add dielectric losses of the structure, that is otherwise loss-free, while the insulator between the conductors (=air) is virtually loss-free. The wider conductor (=the whole support structure covered by the electroconductive material) results in lower conductor losses as well. Also, the manufacturing of the structure results in lower costs, while no masks are needed in order to define the conductor pattern, which is the case, if the support elements are only partially covered by the eletroconductive material.

For all of the foregoing reasons, it is respectfully submitted that all of the claims now present in the application are clearly novel and patentable over the prior art of record, and are in proper form for allowance. Accordingly, favorable reconsideration and allowance is respectfully requested. Should any unresolved issues remain, the Examiner is invited to call Applicants' attorney at the telephone number indicated below.

The Commissioner is hereby authorized to charge payment for any fees associated with this communication or credit any over payment to Deposit Account No. 16-1350.

Respectfully submitted,

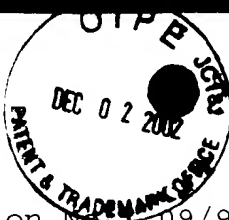

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Application No. 09/937,506

Marked Up Specification Replacement Paragraph(s)

Please delete the paragraph starting on page 1, line 8 through line 26 and replace with the following replacement paragraph:

Various different cable structures are utilised in the construction of electronic appliances. [The higher the employed frequencies, the higher the] As the frequencies of operation increase, there are higher requirements set for the cable structures to be used, in order to prevent attenuation caused by said cable structures. At present, in the structures of electronic appliances, there is generally applied the so-called multilayer technique, which is based either on the HTCC technique (High Temperature Cofired Ceramics) or on the LTCC technique (Low Temperature Cofired Ceramics). With both manufacturing methods, the produced structures consist of several green tapes, with a thickness of about 100 μm , which are positioned one on top of the other. Prior to thermal treatment, the material still is soft, so that in the green tapes, there can be made cavities of desired shapes. Likewise, at desired spots, there can be silk-screened various electrically passive elements. The elastic layers are laminated together by means of pressure. In order to prevent the lamination pressure from collapsing the structure that contains various cavities, the pressurising must be carried out according to a so-called uniaxial method. This means that the pressure is directed to the object only in the direction of the axis z of said object. Finally the created structure is burnt, in the case of LTCC at

850 degrees and in the case of HTCC at 1,600 degrees. In the elements to be produced, at the cavities there are made perforations through which the excess pressure created in the burning process can be let out.

Please delete the paragraph starting on page 1, line 27 through page 2, line 9 and replace with the following replacement paragraph:

In figures 1a and 1b, there is illustrated a possible alternative for realising an inverted microstrip cable based on the HTCC or LTCC multilayer technique according to the description above. In a preferred embodiment, the structure according to figure 1a is achieved by joining together, during the production process but prior to the burning step of the structure, the exemplary elements 12 and 13 illustrated in the drawing. Both of said elements are made layer by layer of some suitable dielectric material in a fashion described above. In the element 13, there is machined a rectangular groove, on the bottom of which there is silk-screened a signal cable 10. The thickness 18 of the element 13, as shown in figure 1b, when measured at the bottom of the groove, is sufficient to prevent disturbing ground potential levels from coming close to the described inverted microstrip cable. In the example illustrated [in the drawing] figure 1b, the angle between the side walls of the groove made in the element 13 and the groove bottom 16, 17 is 90 degrees, but in principle the angles can have some other size, too. On the surface of the element 12, there is silk-screened a ground cable 11, the width whereof corresponds to the width of the groove made in the element 13. The elements 12 and 13 are machined separately, and when they are connected, there

is obtained a structure according to figure 1a, where there is created a gas-filled cable cavity 14.

Please delete the paragraph starting on page 2, line 22 through line 28 and replace with the following replacement paragraph:

However, the use of electric circuits manufactured by the above described techniques becomes problematic, if very high frequencies must be used (RF applications). Signal attenuation in a cable structure realised with LTCC technique at the frequency of 20 GHz rises up to [0,2] 0.2 dB/cm, and in a cable structure realised with HTCC technique up to [0,6] 0.6 dB/cm. In such RF applications where low attenuation is required, for example in filters and oscillation sources having a high quality factor (Q value), the above described techniques are no longer feasible.

Please delete the paragraph starting on page 6, line 14 through line 32 and replace with the following replacement paragraph:

In the embodiment illustrated in figure 3, the signal cable 30 of an inverted microstrip cable is attached to a support element 35, which is narrowed in a triangular fashion towards the bottom of the transmission cable cavity. The cable structure according to the drawing is composed of at least two separate elements 32 and 33. The contact surface of the elements, which in the drawing is illustrated by the dotted line 36, is chosen to be the best possible with respect to the manufacturing of the structure. The contact surface 36 of the elements 32 and 33 can be, as is illustrated, the plane [30] of the signal cable 30 attached to the support element 35, but it can also be some other plane. The support element 35 can be produced in

connection with the production of the element 33, but it can also be produced separately, in which case its contact surface with the element 33 can be a plane which in the drawing is illustrated by the dotted line 37. Part of the electromagnetic field, illustrated by the power lines 34, emitted from the signal cable 30 towards the ground cable 31, proceeds for a short length inside the support element 35. The part of the electromagnetic field that is left inside the support element is smaller than the part left in the bottom substrate in the prior art arrangement illustrated in figure 1b. In the illustrated preferred embodiment, the attenuation per unit of length is thus lower than the attenuation of an inverted microstrip cable according to the prior art.

Please delete the paragraphs starting on page 6, line 33 through page 8, line 8 and replace with the following replacement paragraphs:

In the embodiment illustrated in figure 4, the signal cable 40 of an inverted microstrip cable is attached to a support element 45 that is wider towards the bottom of the groove made in the element 43. The illustrated structure is composed of at least two separate elements 42 and 43. The elements are treated so that inside [them] the elements 42 and 43, there is created a cable cavity according to the illustration. The contact surface of the elements 42 and 43, illustrated by the dotted line 46, is chosen to be the best possible with respect to the manufacturing of the product. The contact surface of the elements 42 and 43 can be, as is illustrated, a plane of the signal cable 40 attached to the support element 45, but it may also be another plane that is advantageous for the manufacturing process. In this embodiment, part of the electromagnetic field, illustrated

by the power lines 44, emitted from the signal cable 40 towards the ground cable 41, proceeds through the support element 45. However, the part that passes through the support element is remarkably smaller than in the case of the prior art inverted microstrip cable illustrated in figure 1b. Thus the attenuation per unit of length also in this embodiment is lower than in a prior art inverted microstrip cable.

In the embodiment illustrated in figure 5, the signal cable 50 of an inverted microstrip cable is attached to a support element 55 having the shape of a T-beam. The walls encasing the transmission cable are composed of at least two elements 52 and 53, and the sectional plane perpendicular to the patterns of said elements, said sectional plane being illustrated by the dotted line 56, is chosen so that the number of work steps in the manufacturing process is [minimised] minimized. The support element 55 can be manufactured in several alternative ways. One alternative is to produce the support element 55 and the signal cable 50 separately, starting from the plane at the base of the T-beam, which plane is illustrated by the dotted line 57. The support element 55 and the signal cable 50 are connected, as a uniform structure, to the element 52. The ground cable 51 can be produced for instance in the way illustrated in connection with figure 1b. When the elements 52, 53 and 55 are connected together, the ground cable 51 is located in the cable cavity on the opposite side of the signal cable 50. In figure 5 it is seen that the electromagnetic field emitted from the signal cable 50 towards the ground cable 51, which field in the drawing is illustrated by the power lines 54, passes only a short way in the dielectric material, in the support element 55. As a consequence, the inverted microstrip cable according to the drawing has an extremely low attenuation per length unit, in

comparison with the attenuation of a prior art inverted microstrip cable.

In the embodiment illustrated in figure 6, the transmission cable structure is composed of at least two elements 62 and 63. The contact surface of the elements 62 and 63, illustrated by the dotted line 66, is chosen to be the best possible with respect to the manufacturing of the product. It may be located at the illustrated point, in which case it is level with the surface of the support element 65, which in the drawing is illustrated by the dotted line 66. In this embodiment, the shape of the support element is inwardly curved. The support element 65 constitutes part of the element 63. Also in this embodiment only a small part of the electric field is emitted from the signal cable 60 towards the around cable 61, which in figure 6 is illustrated by the power lines 64, proceeds in the dielectric material of the support element. Likewise, also in this embodiment the attenuation of an inverted microstrip cable according to the invention is low in comparison with a corresponding prior art transmission cable.



Marked Up Claim

1. (Twice Amended) A transmission cable constructed by multilayer technique, located in a cavity comprising a first surface and a second surface which is essentially parallel with the first surface, said transmission cable [consisting of] comprising:

a signal cable, which is essentially parallel to the first cavity surface, and

[of] a ground cable, which is placed on said second surface, essentially in parallel with the signal cable,

and wherein said transmission cable also comprises a support element which has a surface that is essentially parallel with said first and second surfaces and is located between said first and second surfaces, so that said signal cable is [realised by means of] provided with an electroconductive material layer [formed] disposed on the surface of the support element.